American Association for the Advancement of Science

# SCIENCE

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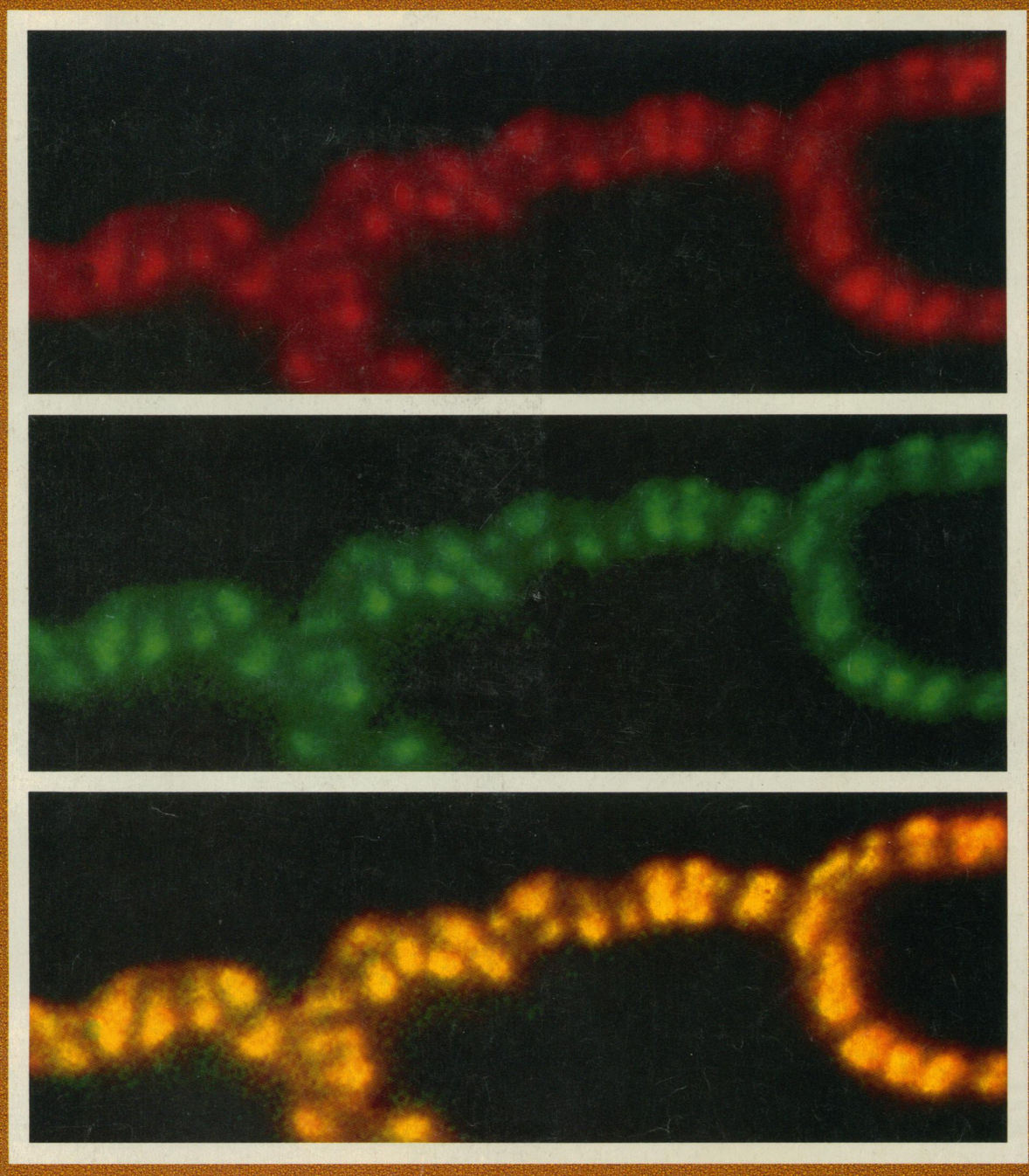

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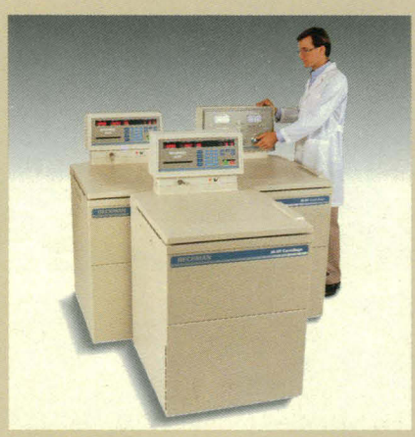

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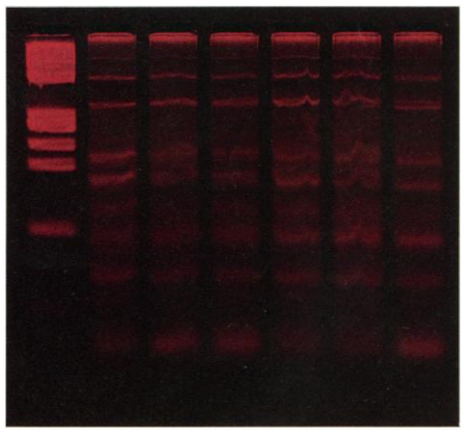

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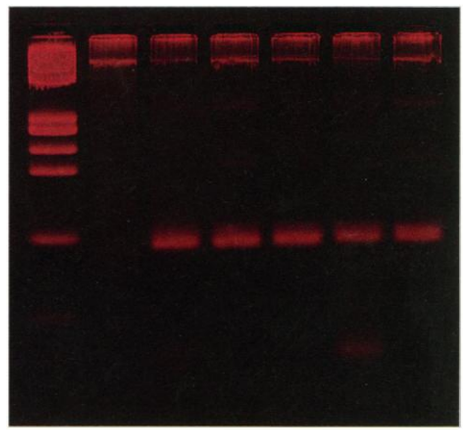

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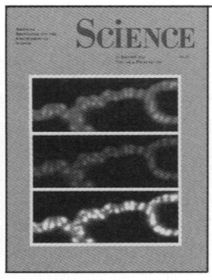


COVER Fluorescence micrographs of a living motor nerve terminal (20 micrometers long) of a frog. The nerve was first stimulated vigorously to label all synaptic vesicles with a dye (top). Each spot is a cluster of vesicles. The nerve was then stimulated briefly to relabel a fraction of the vesicles with a different dye (middle). The uniform yellow color of these two images when superimposed (bottom) shows that the newly recycled vesicles were distributed randomly within the total vesicle pool. See page 200. [Digital film recording by G. W. Hannaway & Associates]

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This Week in
SCIENCE

## State of flux

Superconductors can lose their zero resistivity if placed in a strong enough magnetic field. This effect nas important practical implications for transmission of high electrical current, and it can provide a means to test new theories of order and disorder. Bishop *et al.* (p. 165) review recent experimental results on the properties of the copper oxide superconductors in strong magnetic fields. As the temperature is raised, the lattice of magnetic field lines appears to undergo a phase transition from a glasslike state to a fluidlike state. The authors have also discovered that in weak magnetic fields the glass state exhibits long-range hexatic order [see news article by Freedman (p. 158)].

## East Pacific barrier

The tropical eastern Pacific Ocean is a huge expanse of water where today there are no islands that would aid in dispersing marine organisms. It is thus considered a major barrier to the dispersal of warm-water shelf faunas (invertebrates)—even Darwin saw it as an "impassable barrier." Grigg and Hey (p. 172) look at this dispersal problem during the past 450 million years using the fossil coral and reef records and tectonic plate reconstruction. Dispersion of marine larva in past eras was apparently enhanced by what are today drowned guyots (flat-topped seamounts) and different circulation patterns.

## Protein cavities

By characterizing lysozyme mutants in which cavities were created in the core of the protein, Eriksson *et al.* (p. 178) have been able to shed some light on the relation between the hydrophobic effect and protein folding—nonpolar amino acid side chains tend to be stabilized energetically when they are buried inside the protein. The large side chains of leucine and phenylalanine were replaced with the small methyl group of alanine in six single amino acid mutants and in one double mutant; the crystallographic structures revealed cavities that ranged in size from 24 to 150 cubic angstroms. The resulting destabilization could be expressed as a constant term plus a term that was proportional either to cavity size or volume. It may now be possible to reconcile the different values for hydrophobic strength that have been measured by solvent transfer and by site-directed mutagenesis.

## Current measures

Studies of the resistivity of $K_xC_{60}$ films as a function of potassium doping indicate that, at most compositions, conduction occurs by random percolation, with the electrons moving between conducting grains of $K_3C_{60}$ embedded in a matrix. Kochanski *et al.* (p. 184) measured the temperature and composition dependence of the resistivity of potassium-doped $C_{60}$ films prepared in an ultrahigh vacuum chamber. The films form immiscible phases with a granular microstructure; the conducting $K_3C_{60}$ grains become charged and the energy required to move electrons from grain to grain produces an activation barrier. At stoichiometries near $K_3C_{60}$ the grains coalesce, which limits charging and produces a metallic phase.

## Peeling surfaces

Reconstructions of semiconductor surfaces that extend below the first surface layer can be imaged with the scanning tunneling microscope (STM) by peeling away the first layer by reaction with atomic hydrogen. Boland (p. 186) studied the germanium (111) surface, the outer layer of which forms a $c(2 \times 8)$ structure. Underneath this outer layer is the so-called rest-layer, which may also relax or may retain the bulk structure. Atomic hydrogen selectively reacts with the outer layer, in which the bonds are strained, to form $GeH_4$ or hydrogenated islands; reaction with the rest-layer was so slow as to be undetected. The STM images revealed that the rest-layer assumes a bulk structure.

## Cascadia earthquakes

Geological evidence indicates that great subduction zone earthquakes (magnitudes of at least 7.5 to 7.8) have occurred along the Cascadia subduction zone in the recent past, and that faulting likely accompanied the rupture between the Gorda and North American plates so that the magnitude was probably as great as 8.4. Clarke and Carver (p. 188) used stratigraphic markers in the Humboldt Bay region of northern California to document vertical displacements, such as three offsets of 5 to 7 meters that occurred in the last 1700 years along the Little Salmon fault, as well as other uplift and subsidence events. Carbon-14 dating indicates that faulting, uplift, and subsidence events occurred together. Further characterization of these earthquakes, such as their recurrence intervals, is important in that subduction zone earthquakes generate extensive damage through ground shaking and failure, liquefaction, and the generation of tsunamis.

## Cortex connections

Tangential connections between clusters of cells in the visual cortex may group signals together, for example, to create large receptive fields. These connections are ubiquitous during development and are pruned to create the adult pattern. Löwel and Singer (p. 209) showed directly that connections can be selectively stabilized by visual experience. They artificially induced strabismus in kittens; after this procedure the optical axes of the eyes no longer aligned and the retinal signals were no longer correlated. In area 17, cell clusters were stimulated almost exclusively by one eye or the other, and the tangential fibers preferentially connected the cell groups of one eye.

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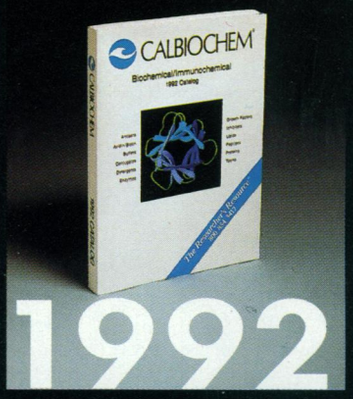


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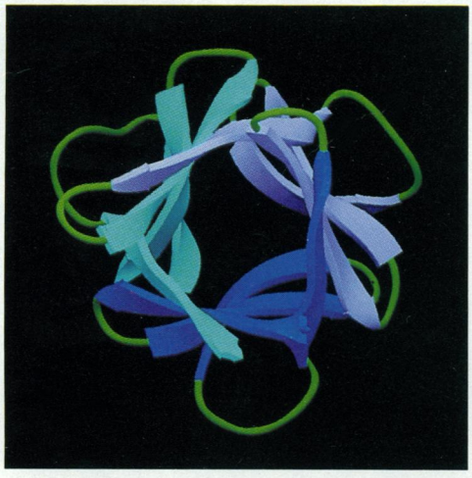

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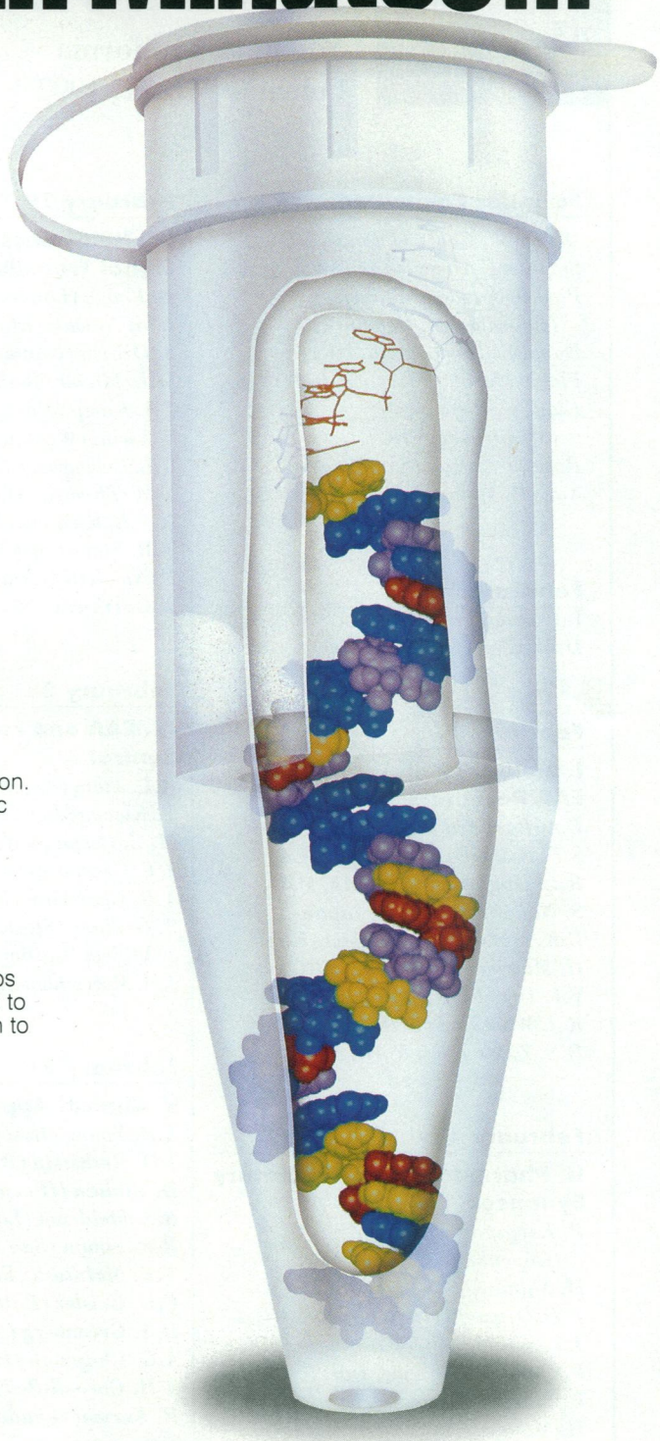

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Introductory Lecture
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## February 21

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# "Here's why GELase™ may replace NaI/glass bead kits for purifying DNA from LMP-agarose gels."

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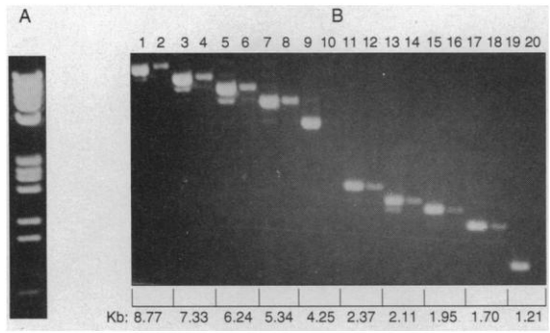
### 1. Recovery of DNA is about 100% using GELase.

NaI/glass bead kits give about 50% recovery for 2–15 Kb DNA (see figure) and much less outside of that size range.




Recoveries of 1.2 to 8.8 Kb DNA fragments excised from a 1% LMP-agarose gel (Figure A) were consistently much greater using GELase (Figure B, odd numbered lanes) than using a commercial kt containing sodium iodide and silica matrix (Figure B, even numbered lanes).

### 2. High molecular weight DNA, even megabase DNA, is not damaged using GELase.

DNA larger than 15 Kb is sheared using NaI/glass bead kits.

### 3. GELase is easy to use.

Just melt the gel slice with GELase Buffer, add GELase and incubate at 40°C to digest. To concentrate the DNA, add ethanol. The gel digestion products are soluble and won't precipitate with the DNA.

### 4. GELase is inexpensive.

**One unit of GELase digests 600 mg of a 1% LMP-agarose gel in 1 hour in GELase Buffer.** With a 10-hour incubation instead of 1 hour, the 200-unit size of GELase is enough to digest more than a KILOGRAM of a 1% gel.

### 5. DNA purified using GELase is ready to use and biologically active.

Some companies recommend two rounds of purification with a NaI/glass bead kit to obtain DNA for cloning. That's not necessary with GELase. DNA recovered using GELase is ready for use in restriction mapping, cloning, labeling, sequencing or other molecular biological experiments.

### 6. GELase is active in electrophoresis buffers.

It digests gels in TAE, TBE, MOPS and phosphate buffers. Special NaI/glass bead kits are needed for gels in TBE buffer.

### 7. Protocols for using GELase are the same for RNA as for DNA.

GELase is RNase-free and active in MOPS or phosphate buffers that are used for RNA gels. In contrast, a special version of NaI/glass bead kit is needed for purification of RNA.

### What is GELase?

GELase is a novel enzyme preparation that digests the carbohydrate backbone of agarose into small soluble oligosaccharides, yielding a clear liquid that will not become viscous or gel even on cooling in an ice bath. It permits simple and quantitative recovery of intact DNA or RNA from low melting point (LMP) agarose gels. GELase contains no contaminating DNase, RNase or phosphatase.

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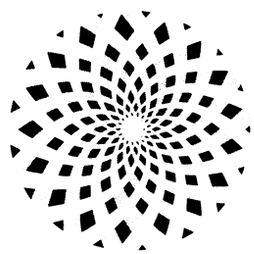

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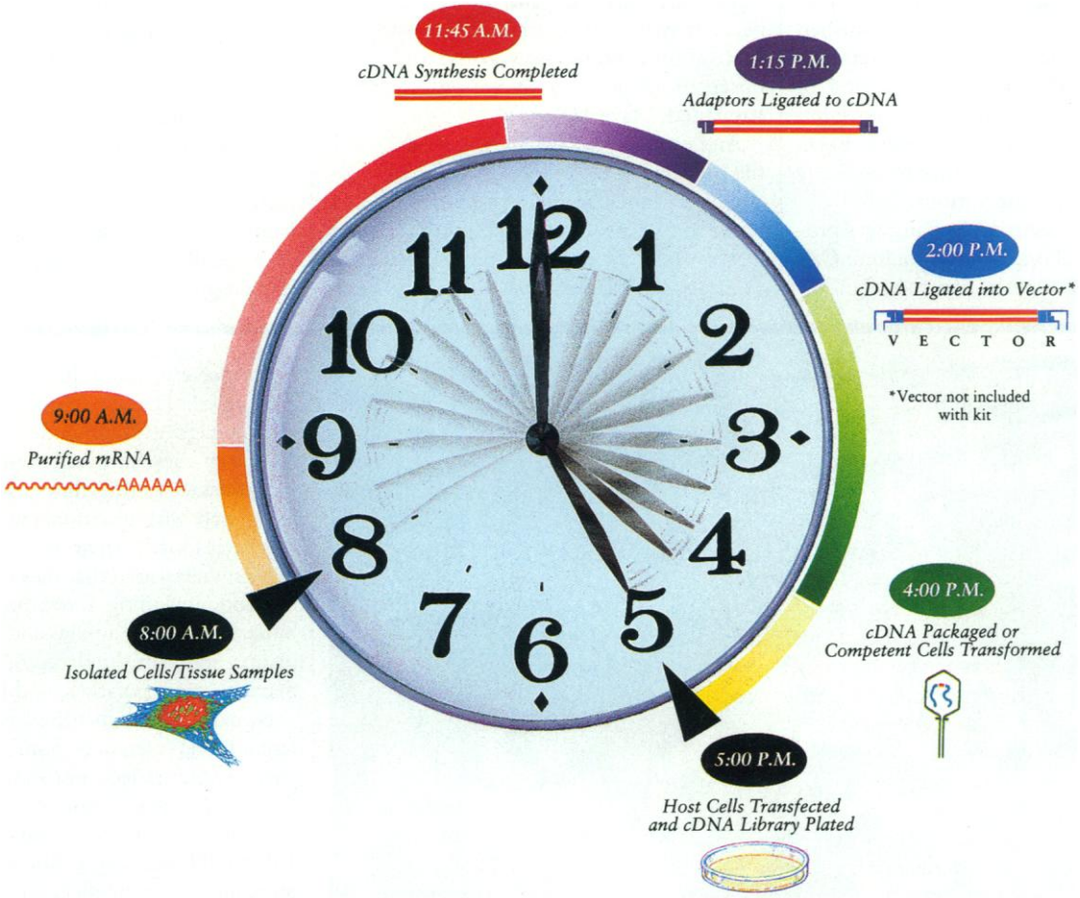
# cDNA Libraries in a Single Day




## TimeSaver™ cDNA Synthesis Kit

PURE PERFORMANCE™

Start in the morning with mRNA, and plate out your cDNA library by the end of the day. It's all in a day's work with TimeSaver™ cDNA Synthesis Kit from Pharmacia P-L Biochemicals.

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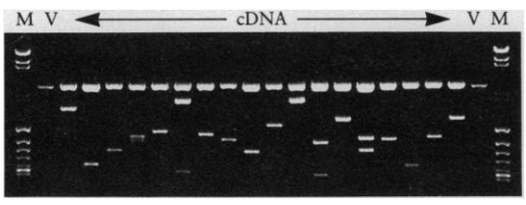


Miniprep analysis of HeLa cell cDNAs made with TimeSaver™ cDNA Synthesis Kit and cloned into pT7T3 18U. M = markers, V = vector alone.

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| | |
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