We repeated the experiments many times, and the results, summarized in Table 1, show clearly that ATPase is increased by irradiation in the normal strain, as seen in other cells by other authors[10,11].

The different behaviour of the resistant strain toward irradiation is shown by the fact that the ATPase remains unchanged.

The behaviour of the two strains is also different in the presence of cystamine: this compound depresses the ATPase of the normal strain when compared with the irradiated sample, but the level still remains higher than that of the control; meanwhile, the depression, in the resistant strain, is more evident and reaches values considerably lower than the control.

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Ornithine in Mucopeptide of Gram-positive Cell Walls

Until recently it had been assumed on the basis of earlier work that the amino-acid composition of the mucopeptide in Gram-positive bacteria always included either α,ε-diaminopimelic acid or lysine. However, a re-examination of the cell walls of some strains of plant pathogenic corynebacteria showed that these two amino-acids may be replaced in some cases by ornithine or diaminobutyric acid; ornithine has also been found in the mucopeptide of *Micrococcus radiodurans*[1].

I have therefore re-examined the cell walls of some other Gram-positive organisms in which lysine had previously been reported, to determine whether other diamino-acids had been missed in previous chromatograms. Acid hydrolysates (6 N HCl, 18 h at 102°–103° C) were prepared and suitable amounts (usually 15–20 μl.) were examined by paper chromatography, as previously described[1] using the methanol : water : pyridine : conc. HCl solvent. The strains examined and the results obtained are recorded in Table 1.

There are three points of interest in these results. First, ornithine seems to have a rather restricted distribution as a major component of mucopeptide in Gram-positive organisms. Secondly, there seems to be a clear distinction between the mucopeptide di-amino acids of *Actinomyces israelii* and *A. bovis*, since the *israelii* strains had lysine and ornithine in approximately equal amounts, while the *bovis* strains had lysine only. Thirdly, the presence of ornithine in the cell walls of the *israelii* strains distinguishes them from the strains of *Arthrobacter*.

Table 1. Presence of Ornithine and Lysine in Mucopeptides from Gram-positive Bacteria

Organism	Mucopeptide amino-acids: Lysine	Ornithine	Others
Strep. pyogenes (A), NCTC 8198	+	−	Ala, Glu.
Lactobacillus casei, NCTC 8019	+	−	Ala, Glu, Asp.
Staph. albus, S3	+	−	Ala, Glu, Gly.
Corynebacterium pyogenes, NCTC 5224	+	−	Ala, Glu.
Arthrobacter:			
A. globiformis, NCIB 8602	+	−	Ala, Glu.
A. citreus, NCIB 8915	+	−	Ala, Glu.
A. aurescens, NCIB 8912	+	−	Ala, Glu.
**Actinomyces:*			
A. israelii, ATCC 12102	+	+	Ala, Glu.
A. israelii, ATCC 12103	+	+	Ala, Glu.
A. israelii, ATCC 10048	+	+	Ala, Glu.
A. bovis, Pine 1	+	−	Ala, Glu, Asp.
A. bovis, 2791	+	−	Ala, Glu, Asp.
A. bovis, B.10	+	−	Ala, Glu, Asp.

* In addition to the three strains listed, six other strains of *A. israelii* have been examined in the same way, and all had a mixture of lysine and ornithine in their cell walls.

In earlier work, where lysine and ornithine were not separated distinctively by the chromatographic methods used, the cell walls of *A. israelii* appeared to have the same qualitative composition as some strains of *Arthrobacter*, although cell wall suspensions from the latter strains did not cross-agglutinate when tested against *israelii* serum[2]. The present findings, which enable the two groups of strains to be distinguished in terms of cell wall composition, are more in keeping with their other properties.

It seems, therefore, that the presence or absence of ornithine in the mucopeptide of Gram-positive organisms is an additional distinguishing feature of possible value in taxonomy. The isomeric form (D- or L-) of the ornithine present in these strains remains to be determined. However, it is known that in *C. betae* the ornithine is in the D-configuration[1].

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Identification of Bacterial Strains by Pyrolysis – Gas-liquid Chromatography

During an investigation concerning the structural features of bacterial cell walls and whole cells and their correlation with immunochemical phenomena, the technique of pyrolysis–gas-liquid chromatography was used in an attempt to exploit possible chemical differences between bacterial strains of similar antigenic or pathogenic character.

Previously, pyrolysis products have been analysed by means of classical chemical methods[1], mass spectrometry[2], and infra-red absorption spectra[3]. Much of the groundwork of pyrohydrolysis on non-volatile organic compounds is due to the extensive investigations of Feigl[4]. Following the introduction of gas-liquid chromatography by James and Martin[5], a pyrolysis examination of synthetic polymers utilizing this form of chromatography was reported[6]. Application of the latter technique was expanded rapidly in widely different areas; yet, curiously enough, very few accounts have dealt with naturally occurring macromolecular or polymeric substances. Among them, Janák[7,8], in particular, has emphasized the considerable analytical potentialities of gas-liquid chromatographic analysis of pyrolytic products.

In the work recorded here, to date, ninety-five analyses have been performed on coded samples of *Escherichia coli* (18 different antigenic strains), *Shigella* sp. (1 strain), Group A *Streptococcus pyogenes* (4 types), and mycobacteria (10 different pathogenic and non-pathogenic forms).

Each strain produced its own unique 'pyrogram' (a chromatogram of pyrolysis products (Fig. 1)). Different cultures of the same strain yielded similar profiles, and in those cases where a coded sample had been divided into two lots, the resulting chromatograms were practically identical. Results from two successive analyses on equal portions of the same sample showed remarkable reproducibility.

The difficulty encountered in the diagnosis of bacterial strains by conventional techniques is well illustrated by