then the chemical evidence suggests that a Janovsky complex would result. The evidence adduced by Kroll et al. against Janovsky complex formation is, to my mind, unconvincing.

In particular, one piece of evidence given by Kroll et al. appears to be incorrect. I quote:

Butler has shown that dicyclohexyl-18-crown-6 ether in benzene reacts with picric acid to form a product that absorbs light similar to compounds in the Jaffé reaction.

I wish I had discovered that. However, all I did (9) was to use the crown to solubilize inorganic anions in benzene where, because of their "nakedness," they formed Meisenheimer complexes not obtained when polar solvents are used.

A simple way of solving the problem of interference is not available, because carbonyl compounds are ubiquitous. With all its limitations, the Jaffé reaction is the only straightforward non-enzymatic method for assay of creatinine.

References

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Organization of a Field Laboratory at an Ultra Marathon

To the Editor:

With the increasing participation of many amateur athletes in tests of endurance such as ultra marathons and triathalons, there is more need for medical attention at the end of these races for those who suffer from the physical and metabolic sequelae of exhaustion. For the past two years an on-site field laboratory has been established at the finish of the "Comrades' Marathon," a 90-km event run under extremes of temperature and humidity. Despite numerous refreshment stations and ancillary support, about 2% of the 10 000 runners required treatment in a medical tent at the end of the race, usually via intravenous replacement. While much is known about the biochemical abnormalities during such extreme exercise (1, 2), medical personnel have never had the advantages of obtaining immediate biochemical results to help in resuscitation on the spot. Here we report our experience in establishing a field laboratory in the medical tent, to provide rapid biochemical results to aid in immediate medical management.

When (e.g.) 10 000 participants run 90 kilometers over a hilly course at temperatures of up to 28 °C, a field laboratory is extremely useful and occasionally life-saving. Experiences learned about organization and equipment are useful not only for such ultraendurance events, but also for provision of field-laboratory services in areas of natural disaster or war.

For the 1986 race we offered assays of the following analytes in plasma from venous blood: sodium, potassium, urea, bicarbonate, glucose, osmolality, creatinine, pH, and blood gases, and we determined venous hematocrit. After the first year we decided that many of these tests were unnecessary for immediate management of the patient and that electrolytes, blood gases, calcium, glucose, osmolality, and hematocrit were all that were required for therapy decisions. Table 1 summarizes the instrumentation used. A range of commercial quality-control specimens were assayed regularly (Wellcome Assayed Normal and Abnormal, Gilford Assayed Normal and Abnormal). As a further check, 20% of the runners' specimens were re-assayed the next day in a hospital laboratory. Patients were identified by marshals at the end of the race and were brought to the medical tent for treatment.

In 1986, about 200 patients were admitted to the tent and, of these, 116 had blood specimens tested. In this year, less seriously affected runners were sent to another station 250 m away and did not have blood tests performed. In 1987, about 400 patients were admitted and 240 specimens received.

Table 1. Equipment Used in a Field Laboratory

<table>
<thead>
<tr>
<th>Year</th>
<th>Instrument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>Beckman BUN 2</td>
<td>(Urea)</td>
</tr>
<tr>
<td></td>
<td>Beckman Instruments, Brea, CA 92621</td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>NovaStat Profile 1</td>
<td>(Sodium, potassium, blood gases, hematocrit, total calcium, ionized calcium)</td>
</tr>
<tr>
<td></td>
<td>Beckman BUN 2</td>
<td>(Urea)</td>
</tr>
<tr>
<td></td>
<td>Beckman Instruments, Brea, CA 92621</td>
<td></td>
</tr>
</tbody>
</table>

Blood was sampled at the time a cannula was inserted for intravenous fluids. We collected 5 to 10 mL into a heparinized tube and 5 mL into a plain tube with no anticoagulant (for subsequent research). The runners' race number and station number in the tent was attached to the specimen. In 1986 we measured and removed blood for hematocrit measurement. The specimen was then centrifuged for 5 min and plasma obtained for assay of osmolality, creatinine, glucose, urea, sodium, and potassium in separate analyzers. Results were collected by a clerk, entered on an adhesive form preprinted by a computer, and returned to the pathologist, who reported them to the attending doctor. Results were obtained in 15–20 min. The requirement for centrifugation led to delays in obtaining results that made many of them of no immediate practical use.

In 1987, all results were obtained with a single whole-blood machine.
The remaining blood was centrifuged for plasma, for evaluation of urea and 
creatinine if requested. Turnaround time was 2–5 min for whole-blood spec-
imens. This shorter time led to prompt diagnosis and management. Eight per-
cent of the patients were hyponatraemic, 73% had above-normal creatinine, 
40% had above-normal urea, and 32% were hypoglycemic.

In both years, we experienced prob-
lems with the heat; the temperature 
ocasionally rose to 30 °C in the shade. 
Despite the removal of tent-flaps and 
the use of fans, equipment occasionally 
overheated, leading to delays. Reloca-
tion to another part of the tent would 
have solved this problem but was not 
possible because of the location of the 
power supply.

In 1986, two analyzers were found to 
be faulty despite thorough testing the 
previous day. In one case, spares had to 
be obtained and in another the com-
pany’s serviceman was present to solve 
the problem. In 1987 the NovaStat 
equipment worked perfectly except for 
problems of temperature.

In certain patients, particularly 
those who had been confused, uncon-
scious, complaining of severe cramps, 
or had a history of renal disease, lab-
oratory assessment proved invaluable. 
Detection of patients with hyponatre-
mia was also important, to avoid ad-
ministering large quantities of hypo-
tonic fluid to them.

We have demonstrated that it is 
possible to organize a field laboratory 
that gives rapid, reliable, and clinically 
useful information in a medical tent 
catering to the resuscitation of ama-
teur athletes who are undergoing 
physical stresses encountered in high 
heat and humidity in an ultramar-
athon.

In summary, we offer the following 
recommendations for operating a lab-
oratory under such conditions:

- Locate laboratory in coolest possi-
ble place with good ventilation.
- Avoid centrifugation if at all possi-
ble (use whole-blood machinery).
- Have tested back-up equipment 
available as well as spares.
- Report rapid results on a few impor-
tant analytes (sodium, hematocrit) 
which is more valuable than slower, 
more detailed results.
- Link up results to the race comput-
er if possible.

References
1. McKechnie JK, Leary WP, Noakes TD. 
Metabolic responses to a 90 km running 
2. Noakes TD, Kotzenburg G, McArthur

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**Table 1. Patients with Discordant TSH Values**

<table>
<thead>
<tr>
<th>Patient</th>
<th>FT4, pmol/L</th>
<th>T3, nmol/L</th>
<th>TSH, mIU·mL⁻¹</th>
<th>Age, y</th>
<th>Clinical Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: Patients with euthyroid multinodular goiter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14.3</td>
<td>1.3</td>
<td>0.6</td>
<td>&lt;0.05*</td>
<td>85</td>
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<tr>
<td>2</td>
<td>10.2</td>
<td>2.2</td>
<td>1.4</td>
<td>&lt;0.05*</td>
<td>46</td>
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<tr>
<td>b: Patients on drug therapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>21.7</td>
<td>2.2</td>
<td>1.3</td>
<td>&lt;0.05</td>
<td>53</td>
</tr>
<tr>
<td>c: Elderly patients treated for nontyroidal illness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>21.0</td>
<td>1.1</td>
<td>0.6</td>
<td>0.13</td>
<td>78</td>
</tr>
<tr>
<td>6</td>
<td>21.2</td>
<td>1.6</td>
<td>1.6</td>
<td>&lt;0.05</td>
<td>71</td>
</tr>
<tr>
<td>7</td>
<td>20.5</td>
<td>2.5</td>
<td>0.3</td>
<td>&lt;0.05</td>
<td>73</td>
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<tr>
<td>10</td>
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<td>0.7</td>
<td>0.8</td>
<td>0.09</td>
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<td>15.2</td>
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<tr>
<td>12</td>
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<tr>
<td>14</td>
<td>15.0</td>
<td>1.0</td>
<td>0.4</td>
<td>&lt;0.05</td>
<td>78</td>
</tr>
</tbody>
</table>

*Detection limits: <0.05 mIU·mL⁻¹.